CRWMS/M&O

Non-Q Design Analysis Cover Sheet

Complete only applicable items.

(1.) QA: N/A

Page: 1 Of: 5

2. DESIGN ANALYSIS TITLE		
NORTH PORTAL - DOMESTIC COLD WATER CALCULATION - CHANGE HOUSE FACILITY #5008 (SCPB: N/A)		
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1	I-1	MGDS

	Print Name	Signature	Date
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13. Remarks

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4. Revision No.	5. Description of Revision
00	Initial Issue
01	Reformatted to conform to NAP-MG-013, Rev. 0 Revised Title Deleted TBV-122 Changed QA Classification to QA: N/A

1. PURPOSE

The purpose of this design analysis and calculation is to determine the demand for domestic cold water and to size the supply main piping for the Change House Facility #5008 in accordance with the Uniform Plumbing Code (Section 4.4.1) and U.S. Department of Energy Order 6430.1A-1540 (Section 4.4.2).

2. QUALITY ASSURANCE

This analysis is non-Q because it is for a temporary item. A Determination of Importance Evaluation (Reference 5.1) of the Change House Facility has determined that no quality assurance (QA) controls are applicable with the context of this analysis.

3. METHOD

The method used for the calculations is based on the Uniform Plumbing Code (UPC), Section 4.4.1. The first step is to determine the maximum pressure drop between the most remote cold water plumbing fixture and the main distribution supply. The developed length of pipe from the supply to the fixture is then determined from the plumbing drawings. The maximum pressure drop is then divided by the developed length which results in the friction loss per 100 feet of pipe. Equivalent fixture units are assigned from the UPC based on the actual fixture count which when totalled determines the water flow rate. The water flow rate and pressure drop are used to determine the pipe size based on a given velocity of flow.

4. DESIGN INPUTS

4.1 DESIGN PARAMETERS

Water supply main pressure = 60 pounds per square inch (psi) (Reference 5.2)

Pressure at most hydraulically remote fixture = 15 psi (Reference 5.3)

Velocity of flow = 5 feet per second (Reference 5.4)

Number of Fixture Units = 319 (Attachment I)

4.2 CRITERIA

The Plumbing Design for the Change House Facility will be designed in accordance with DOE Order 6430.1A (Section 4.4.2) and appropriate state and local codes (ESFDR Sections 3.2.1Q, 3.2.1R, and 3.2.1S, Reference 5.6).

4.3 ASSUMPTIONS

Not used.

4.4 CODES AND STANDARDS

4.4.1 International Association of Plumbing and Mechanical Officials:

UPC 1991 Uniform Plumbing Code (UPC)

4.4.2 U.S. Department of Energy (DOE):

DOE Order 6430.1A-89 General Design Criteria

5. REFERENCES

5.1 Document Identifier: BABBA0000-01717-2200-00007 REV 00 Determination of Importance Evaluation for ESF Change House Facility and Shop Building

5.2 Water Supply Analysis B00000000-01717-0200-000174 REV 01

5.3 Exploratory Studies Facility Basis for Design BAB000000-01717-6300-00002 REV 05

5.4 Crane Technical Paper No. 410, "Flow of Fluids," Crane Co., 1988

5.5 Plumbing Drawings:

5.5.1 BABBAF000-01717-2100-27150-01 Change House - Bdg 5008 Plumbing Isometrics and Details

5.5.2 BABBAF000-01717-2100-27151-00 Change House - Bdg 5008 Plumbing and Piping Plan

5.5.3 BABBAF000-01717-2100-27152-00 Change House - Bdg 5008 Plumbing Enlarged Plans

5.6 Yucca Mountain Site Characterization Project Exploratory Studies Facility Design Requirements, YMP/CM-0019, Rev. 1, ICN 3.

6. USE OF COMPUTER SOFTWARE

Not used.

7. DESIGN ANALYSIS

The allowable pressure drop based on the design parameters in Section 4.1 is 45 psi. The distance from the distribution main to the most remote plumbing fixture is 210 feet as obtained from the plumbing drawings (Reference 5.5). The pressure available for friction loss per 100 feet of pipe is 45 psi/210 feet times 100 feet equals 21.42 psi for zero flow.

The quality of cold water required to be supplied to each plumbing fixture is represented by fixture units assigned by the UPC (Section 4.4.1). For the Change House Facility, 319 fixture units are identified as shown in Attachment I. The demand load for 319 fixture units is 112 gpm.

8. CONCLUSIONS

Based on the allowable friction loss per 100 feet of pipe and the total demand of 112 gpm, a 3-inch building supply main is required.

9. ATTACHMENTS

ATTACHMENT	TITLE
I	Calculations

CALCULATIONS

DOMESTIC COLD WATER				
Fixture	No. Req'd A*	Units per Fixture B**	Fixture Units A x B	Remarks
Water Closet	10	10	100	
Urinal	5	5	25	
Lavatory	7	2	14	
Wash Fountain	2	4	8	
Shower	28	4	112	
Service Sink	3	4	12	
Mop Sink	2	4	8	
Lab Sink				
Cup Sink				
Kitchen Sink				
Electric Water Cooler				
Hose Bibb	4	5	20	
Boot Wash	5	4	20	
TOTAL FIXTURE UNITS			319 = 112 GPM = 3" Supply***	

* Number of Fixture Units required are obtained from References 5.5.1, 5.5.2, and 5.5.3.

** Units per Fixture values are obtained from Table 10-1 of UPC (Section 4.4.1).

*** Total GPM was taken from Chart A-2 of Appendix A of UPC (Section 4.4.1). A 3-inch diameter (copper tubing) supply line is required for a cold water demand of 112 GPM and velocity of 5 ft/sec (Reference 5.4).